PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-001029
(43)Date of publication of application : 07.01.2003

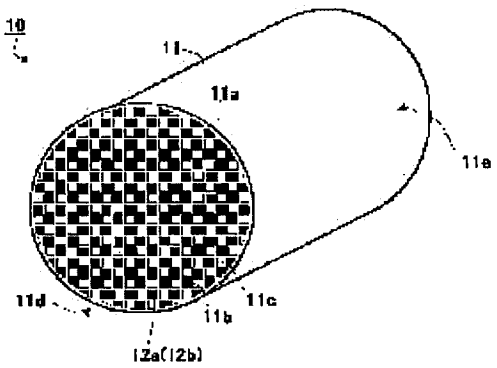
(51)Int.Cl. B01D 39/20
C04B 38/00
F01N 3/02

(21)Application number : 2001-184060
(22)Date of filing : 18.06.2001

(71)Applicant : HITACHI METALS LTD
(72)Inventor : SUWABE HIROHISA
OTSUBO YASUHIKO

(54) POROUS CERAMIC HONEYCOMB FILTER

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a porous ceramic honeycomb filter which has a porous ceramic honeycomb structure, has an outer peripheral wall and many cells surrounded by cell walls on the inner peripheral side of the outer peripheral walls and the one end face of which is sealed by using a sealant, for collecting fine particles contained in exhaust gas by the cell walls by making the exhaust gas pass through the pores of the cell walls and flow through the adjacent cells and whose fine particle collecting efficiency is high and whose pressure loss is low even when the porosity of the cell wall is ≥55% and a catalyst is deposited on the porous ceramic honeycomb filter.
SOLUTION: The porosity of the cell wall is 55–75%, the average pore size is 10–40 μm and the surface roughness (the maximum height Ry) is ≥10 μm.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A peripheral wall.
A cell of a large number surrounded with a cell wall by the inner circumference side of this peripheral wall.
It is the porosity ceramic honeycomb filter provided with the above, and porosity of said cell wall is characterized by an average pore size's being 10-40 micrometers, and surface roughness (maximum height Ry) being not less than 10 micrometers 55 to 75%.

[Claim 2]The porosity ceramic honeycomb filter according to claim 1, wherein porosity of said cell wall is 60 to 70%.
[Claim 3]The porosity ceramic honeycomb filter according to claim 1 or 2, wherein a main crystal of ceramics which constitute said cell wall is cordierite.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the porosity ceramic honeycomb filter which catches the particles contained in exhaust gas, such as a diesel power plant.
[0002]
[Description of the Prior Art]Reduction of the toxic substances contained in the exhaust gas discharged from engines, such as a car, from the preservation side of local environment or earth environment is called for. In order to catch the particles especially contained in exhaust gas, such as a diesel power plant, a porosity ceramic honeycomb filter (henceforth [a "porosity ceramic honeycomb filter" is omitted and] a "honeycomb filter") attracts attention, and has come to be used.
[0003]Drawing 1 is a perspective view of the honeycomb filter 10, and drawing 2 is a type section figure of the honeycomb filter 10 of drawing 1. As shown in drawing 1 and drawing 2, usually the honeycomb filter 10, The porosity ceramic honeycomb structured body which has the cell 11c of a large number approximately cylindrical and surrounded with the cell wall 11b by the inner circumference side of the peripheral wall 11a and this peripheral wall 11a. (Hereafter, a "porosity ceramic honeycomb structured body" is omitted and it is called a "honeycomb structured body") The inflow side of the cell 11c of 11 is ******(ing) the both-ends side by the side of [11e] 11 d and an outflow by the ****** material 12a and 12b by turns. And the honeycomb filter 10 is stored by the metal vessel by the planar pressure of gripping members, such as a ceramic fiber mat inserted as a compression state within the metal vessel (not shown).
[0004]Exhaust gas purification with the honeycomb filter 10 is performed as follows. By drawing 2, exhaust gas flows from the cell 11c as for which the inflow side of the honeycomb filter 10 is carrying out the opening at 11 d (10a shows), flows into an adjacent cell from the fine pores (not shown) formed in the cell wall 11b, and is discharged from the outflow side 11e (10b shows). And when particles contained in exhaust gas pass to an adjacent cell from the fine pores which continue within the cell wall 11b, they are filtered, and they are caught. And if a fixed quantity of caught particles become above, combustion removing will be carried out by electric heater, a burner, etc., and reproduction of the honeycomb filter 10 will be performed.
[0005]There is also a method of lowering the combustion temperature of particles and burning the caught particles continuously by supporting catalysts, such as a platinum metal metal catalyst, to the fine pores (not shown) formed in the cell wall 11b and the cell wall 11b of the honeycomb filter 10. Now, it is required for the honeycomb filter 10 that the collection efficiency of particles is high and that pressure loss should be low. If the collection efficiency of particles is high and pressure loss is low, the increase in back pressure in the engine accompanying accumulation of particles will become slow, the time which can continue catching will become long, and the interval to reproduction will also become long. However, generally, collection efficiency and pressure loss have a relation of reverse proportion, if it is going to make collection efficiency high, pressure loss will increase, and on the other hand, if it is going to make pressure loss low, collection efficiency will come to get worse. The porosity and average pore size of the cell wall of the honeycomb filter were adjusted so that collection efficiency and pressure loss could be compatible conventionally, but there was a limit. When burning particles continuously with the catalyst supported especially, as a carrier high specific surface area materials, such as activated alumina, from it being necessary to coat the inside of the fine pores of a cell wall. It was difficult for high specific surface area material to blockade the fine pores of a cell wall, and for pressure loss to become high compared with the filter which is not coated, and to obtain the filter of a low-pressure power loss with high collection efficiency.
[0006]In order to solve the above-mentioned problem, to JP,7-163823,A. In addition to considering it as 60% or

less not less than 45%, the porosity of a cell wall toward an inside from the surface The specific surface area M of an opening and all the fine pores to penetrate (m^2/g). By making a relation with surface roughness N (micrometer) in the filter surface into the range of 1000M+85N >=530. The number of the fine pores which were chained with the inside and penetrated is made to increase from a filtering area and a filter surface, catching time is long and the honeycomb filter in which it could be made to lessen reproduction frequency is indicated.
[0007]For porosity to be carried out not less than 40%, and for an average pore size be not less than 5 micrometers 50 micrometers or less 55% or less at JP,8-931,A the value as for which Valley Level becomes by in addition, the thing to consider as 20% or less. The detachability of the particles caught on the honeycomb filter surface becomes good, and the honeycomb filter which was going to improve regeneration efficiency by back wash exhaust air is indicated. With Valley Level, three-dimensional analysis of the data of the granularity of a filter surface is conducted with a tracer type surface roughness meter here, The field that the volume of the heights of a filter and the volume of a crevice became equal to a certain field was made into the average side, and when it assumes that the filter was cut in respect of this average, it is defined as the ratio to the total surface area of the sum of the fine-pores area in an average side.
[0008]
[Problem(s) to be Solved by the Invention]However, the honeycomb filter of the indication to said JP,7-163823,A, The effect which enlarges the collection surface product of a cell wall by 2.3-7.4 micrometers and a comparative example since it is about 3.1-7.4 micrometers in the example as given [surface roughness] in Table 2 of the gazette was not acquired, but there was a problem that the collection efficiency of particles was also low, substantially. For this reason, pressure loss was low and it was difficult to obtain a filter with high collection efficiency of particles moreover.
[0009]Porosity is not less than 40% of 55% or less, and the honeycomb filter of the indication to said JP,8-931,A had the problem of being easy to increase pressure loss. Although the detachability of the particles caught on the surface by making into 20% or less the value which becomes Valley Level became good, there was also a problem that there were few effects of catching the particles in exhaust gas with a cell wall. In JP,8-931,A, a concrete statement is not found about the value of surface roughness.
[0010]In light of the above-mentioned problems, this invention enlarges the porosity of a cell wall, and suppresses pressure loss low, and there is in obtaining a honeycomb filter with high collection efficiency of the particles in exhaust gas.
[0011]
[Means for Solving the Problem]This invention persons were specifying porosity in a honeycomb filter, and an average pore size, and making surface roughness (maximum height Ry) of a cell wall large beyond a predetermined value, acquired knowledge that an aforementioned problem is solvable, and thought out to this invention.
[0012]Namely, a honeycomb filter of this invention ****** an end face of a cell of a honeycomb structured body which has a cell of a large number surrounded with a cell wall by the inner circumference side of a peripheral wall and this peripheral wall, It is a honeycomb filter which catches particles which pass fine pores of said cell wall, pass exhaust gas to an adjacent cell, and are contained in exhaust gas with said cell wall, Porosity of said cell wall is characterized by an average pore size's being 10-40 micrometers, and surface roughness (maximum height Ry) being not less than 10 micrometers 55 to 75%.
[0013]It is because collection efficiency of particles will fall, and intensity will also fall, if pressure loss becomes it large that porosity is less than 55% and porosity exceeds 75%, so it is not suitable here as a filter for particle catching to have made porosity of a cell wall into 55 to 75%. The more desirable range of porosity is 60 to 70%.
[0014]That an average pore size of a cell wall was 10-40 micrometers, It is because detailed particles will penetrate a cell wall, and collection efficiency will fall, and intensity will also fall, if pressure loss becomes it large that an average pore size is less than 10 micrometers and an average pore size exceeds 40 micrometers, so it is not suitable as a filter for particle catching. Porosity and an average pore size are measured using a mercury pressure ON type porosimeter.
[0015]That surface roughness (maximum height Ry) of a cell wall was not less than 10 micrometers, In spite of having set up so that 55 to 75% may be stopped in porosity and 10-40 micrometers and pressure loss may be low suppressed in an average pore size, it is because it becomes possible to catch particles efficiently by an uneven part formed in the cell wall surface. There are few effects that surface roughness (maximum height Ry) of a cell wall catches particles in exhaust gas with a cell wall in less than 10 micrometers, and they are not suitable as a filter for particle catching. The more desirable range of surface roughness (maximum height Ry) of a cell wall is 20-100 micrometers.

[0016]And as for a main crystal of ceramics which constitute a cell wall, it is preferred that it is cordierite. Although it is because heat resistance sufficient as a filter for particle catching, thermal shock resistance, and a mechanical strength are obtained as a main crystal of ceramics which constitute a cell wall is cordierite, This invention is not limited to this and can use materials, such as other heat-resistant ceramics, for example, mullite, alumina, silicon nitride, silicon carbide, nitriding aluminum, lithium aluminium silicate, aluminum titanate, and zirconia.
[0017]
[Embodiment of the Invention]Hereafter, an embodiment of the invention is described in detail.
[0018]The honeycomb filter 10 shown in drawing 1 thru/or drawing 2 was produced as follows.
(Adjustment of basic-raw-materials powder) Measure powder, such as kaolin, talc, silica, hydroxylation aluminum, and alumina, and chemical composition with a mass ratio. SiO_2: 47-53%, aluminum$_2O_3$:32-38%, MgO: Ceramics raw material powder was adjusted so that it might become 12 to 16%.
[0019](Plastic matter adjustment for honeycomb structured bodies) As a forming assistant, the quantity of graphite, wheat flour, starch, resin powder, a foaming agent, etc. was changed, and it added as binders, such as methyl cellulose, and lubricant, and an ostomy agent, to ceramics raw material powder, and mixed enough by dry type. Subsequently, the water of the stipulated amount was poured in, still more sufficient mixing was performed, and after shaping mentioned later and calcination, the plastic matter was produced so that the porosity, the average pore size, and surface roughness (maximum height Ry) of the various kinds of a honeycomb structured body might be obtained.
[0020](Extrusion molding) Next, extrusion molding of the plastic matter was carried out using the extrusion-molding public-funds type of a general structure, and the section surrounded with a cell wall produced the Plastic solid which has the honeycomb structure of quadrangular shape.
[0021](Calcination) Calcinate using a batch type firing furnace and, in 150 mm and cell wall thickness, 0.43 mm and the number of cells per 1-cm^2 the Plastic solid which has honeycomb structure by 16 pieces. [the outer diameter of the peripheral wall 11a] [150 mm and length] The honeycomb structure baking body which consists of various kinds of porosity, an average pore size, and nature ceramics of cordierite that have the surface roughness (maximum height Ry) of a cell wall was obtained.
[0022](******) Next, after sticking a masking film on the both-ends side of the baking body which has honeycomb structure with adhesives, it punched so that it might become a checker, and checkered ****** material was introduced into the end, the eye sealed part was formed, and the honeycomb filter 10 was obtained.

[0023](Measurement of porosity, an average pore size, and surface roughness (maximum height Ry)) The sample was started from the obtained honeycomb filter 10, and (%) and the porosity of a cell wall, an average pore size (micrometer), and surface roughness (maximum height Ry) were measured. The porosity (%) and average pore size (micrometer) of the cell wall were measured with the method of mercury penetration using product [made by Micromeritics] auto pore III9410. Semi- [of the surface roughness (maximum height Ry)] was carried out to B (JIS) 0601-1994, and it was measured several places.
[0024](Measurement of collection efficiency and pressure loss) a honeycomb filter -- ten -- particle diameter -- 0.042 -- micrometer -- carbon powder -- three -- g/h -- two -- an hour -- having supplied -- the back -- (-- a --) -- collection efficiency -- (-- % --) -- [(input-discharge) -- /(input) --] -- an inflow -- a side -- 11 -- d -- an outflow -- a side -- 11 -- e -- differential pressure -- having measured . And differential pressure was made into (b) pressure loss (mmAq). From on practical use, that in which (a) collection efficiency is not less than 90%, and (b) pressure loss exceeds [less than 360 mmAq] right (O) and 400mmAq for A (O) and 360 - 400mmAq was set to NG (x), and was evaluated (c). Collection efficiency evaluated less than 90% of thing as NG (x).
[0025]The result of (a) collection efficiency over the porosity, the average pore size, and surface roughness of the honeycomb filter 10, (b) pressure loss, and (c) evaluation is shown in Table 1.
[0026]
[Table 1]

	気孔率 (%)	平均細孔径 (μm)	表面粗さ Ry(μm)	(a)捕集率 (%)	(b)圧力損失 (mmAq)	(c)評価
発明例 1	62.8	14.9	15～30	95	382	○
発明例 2	62.4	14.4	48～68	97	378	○
発明例 3	65.4	14.6	67～89	98	381	○
発明例 4	60.2	16.8	68～76	98	382	○
発明例 5	66.8	19.5	57～74	96	377	○
発明例 6	67.2	21.8	63～79	98	365	○
発明例 7	65.5	30.8	22～44	96	353	◎
発明例 8	68.3	33.7	45～62	98	328	◎
発明例 9	56.8	14.9	47～68	99	396	○
発明例10	70.1	19.7	67～78	96	332	◎
比較例 1	62.4	14.8	3～ 7	87	378	×
比較例 2	45.2	7.7	3～ 7	98	448	×
比較例 3	61.0	9.1	12～14	98	420	×
比較例 4	69.1	48.3	32～55	82	322	×
比較例 5	76.2	30.4	51～70	80	310	×

[0027]As for the examples 1-10 of an invention, Table 1 shows that porosity serves as high the honeycomb filter 10 with little pressure loss in collection efficiency since 55 to 75% and an average pore size are 10-40 micrometers and surface roughness (maximum height Ry) is not less than 10 micrometers.
[0028]On the other hand, since it is outside 55 to 75% of porosity, 10-40 micrometers of average pore sizes, and the range of not less than 10 micrometers of surface roughness (maximum height Ry) any of porosity, an average pore size, and surface roughness (maximum height Ry) they are, as for the comparative examples 1-5, evaluation of collection efficiency and/or pressure loss is low.
[0029]
[Effect of the Invention]In details, above as explanation the honeycomb filter of this invention, Since porosity is carried out, the average pore size is 10-40 micrometers 55 to 75%, a low-pressure power loss is acquired and the surface roughness on the surface of a cell wall is not less than 10 micrometers, it becomes possible to be efficient and to catch the particles in exhaust gas, and extension of catching time is attained.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a perspective view of a honeycomb structured body.
[Drawing 2]It is a cross section of an example of the exhaust gas purifying filter 10 using the honeycomb structured body of drawing 1.
[Description of Notations]
10a: Inflow
10b: Discharge
10: Porosity ceramic honeycomb filter (honeycomb filter)
11: Porosity ceramic honeycomb structured body (honeycomb structured body)
11a: Peripheral wall
11b: Cell wall
11c: Cell
11d: Inflow side
11e: Outflow side
12a, 12b: ****** material

[Translation done.]